SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 51$ from the following data

| $x$ | 50 | 60 | 70 | 80 | 90 |
|---|---|---|---|---|---|
| $y$ | 19.96 | 36.65 | 58.81 | 77.21 | 94.61 |

17. Evaluate $\int_0^{10} \frac{dx}{1+x^2}$ by using

(a) Trapezoidal rule

(b) Simpson's $\frac{1}{3}$ rule.

18. Solve the difference equation $y_{n+2} + y_{n+1} + 2y_n = \sin 2n$.

19. Using Taylor's series method find $y$ at $x = 0.1$ ad 1.2 by solving $\frac{dy}{dx} = x^2 + y^2$ given $y(1) = 2.3$.

20. Using Runge – Kutta method of fourth order solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ at $x = 0.2, 0.4$.



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**APRIL/MAY 2025**

# 23UEAI22A/23UECS22A/23UEDA22B/ 23UEIM22A/23UEMA23/23UESC22A — NUMERICAL METHODS II

Time : Three hours Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Write the Striling's formula to compute $f'(x)$ at $x = x_0$.

2. Write Newton's Forward and Backward Difference Formula.

3. Write Simpson's $\frac{1}{3}$ rule.

4. State Weddle's rule.

5. Solve the difference equation: $u_{n+2} - 2u_{n+1} + u_n = 0$.

6. Find particular integral for $u_{n+1} - 2u_n = 3^n n^2$.

7. State the formula for Taylor's series method.

8. Write Picards iteration formula.

9. Write down the Modified Euler's formula for $y' = f(x,y), y(x_0) = y_0$.

10. Write the Runge-Kutta formula of fourth order.

SECTION B — ($5 \times 5 = 25$ marks)

Answer ALL questions.

11. (a) From the following table obtain $\frac{d^2y}{dx^2}$ at the point $x = 0.96$.

| $x$ | 0.96 | 0.98 | 1.00 | 1.02 | 1.04 |
|---|---|---|---|---|---|
| $f(x)$ | 0.7825 | 0.7739 | 0.7651 | 0.7563 | 0.7473 |

Or

(b) From the following table, what values of $x$, $y$ minimum?

| $x$ | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| $y$ | 0 | $\frac{1}{4}$ | 0 | $\frac{9}{4}$ | 16 | $\frac{225}{4}$ |

12. (a) Compute the value of $\int_0^1 \frac{dx}{1+x}$ using Simpson's one third rule.

Or

(b) Evaluate $\int_0^1 \frac{dx}{1+x}$ using Weddle's rule.



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13. (a) Solve the difference equation $y_{n+2} - 3y_{n+1} + 2y_n = 5^n$.

Or

(b) Solve the difference equation $y_{n+2} - 3y_{n+1} - 4y_n + 12 = 0$.

14. (a) If $\frac{dy}{dx} = 1 - 2xy$; $y(0) = 0$ compute $y(0.1)$ correct to 3 place of decimals using Taylor's method.

Or

(b) Using picards method find $y$ when $x = 0.1$, given that $y = 1$ when $x = 0$ and $\frac{dy}{dx} = \frac{y-x}{y+x}$.

15. (a) Given $\frac{dy}{dx} + y - x^2 = 0$, $y(0) = 1$, $y(0.1) = 0.9052$, $y(0.2) = 0.8213$, find correct to four decimal places $y(0.3)$ using modified Euler's method.

Or

(b) Find $y(0.2)$ from $y' = y - x, y(0) = 2$ taking $h = 0.1$ using fourth order Runge – Kutta method.